ZOLL M SERIES SERVICE MANUAL

Temperature

9653-0458-01 Rev. B

The issue date or revision level for this operation guide is shown on the front cover.
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Preface

ZOLL Medical Corporation's *M Series Service Manual* is intended for the service technician who identifies malfunctions and makes repairs at the subassembly level. Place this insert into the three-ring binder containing the *M Series Service Manual* and all other M Series option inserts.

This document provides information required for maintenance of the Temperature option on the M Series CCT unit, and contains the following sections:

Principles of Operation on page 1 — provides a general overview of Temperature functionality.

Maintenance Procedures on page 3 — describes procedures for verifying Temperature operation and integrity.

Disassembly Procedures on page 6 — describes procedures for removing the Temperature connector from the lower housing assembly.

Replacement Parts on page 9 — lists the field-replaceable parts for the Temperature option and provides information on ordering replacement parts from ZOLL.

Troubleshooting on page 10 — describes error messages related to Temperature functionality and their corresponding corrective action.

Conventions

This *M Series Service Manual* insert uses the following conventions:

Warning! **Warning statements describe conditions or actions that can result in personal injury or death.**

CAUTION Caution statements describe conditions or actions that can result in damage to the unit.

Note: Notes contain additional information on using or maintaining the M Series unit.

Additional M Series documentation

For more information on M Series operation, see the following documents:

- *M Series Temperature* insert (part number 9650-0220-01) of the *M Series Operator's Guide* — describes user tasks for the Temperature option.
- *M Series Operator's Guide* (part number 9650-0200-01) — describes user tasks for general operation of the M Series unit.
- *M Series Configuration Guide* (part number 9650-0201-01) — describes the M Series features and functions whose operation can be customized by authorized users.

Safety Considerations

Service technicians should review these safety considerations prior to servicing any equipment and read the manual carefully before attempting to disassemble the unit. Only qualified personnel should service the M Series unit.

Federal (U.S.A.) law restricts this unit for use by or on the order of a physician.

Non-ZOLL manufactured accessories

Safety and effectiveness data submitted by ZOLL Medical Corporation to the Food and Drug Administration (FDA) under section 510(K) of the Medical Device Act to obtain approval to market is based on the use of ZOLL accessories such as disposable electrodes, patient cables and batteries. The use of external pacing/defibrillation electrodes and adapter units from sources other than ZOLL is not recommended.

ZOLL makes no representations or warranties regarding the performance or effectiveness of its products when used in conjunction with pacing/defibrillation electrodes and adapter units from other sources. If unit failure is attributable to pacing/defibrillation electrodes or adapter units not manufactured by ZOLL, this may void ZOLL's warranty.

Warnings

All persons near the equipment must be warned to "STAND CLEAR" prior to discharging the defibrillator.

Warning!

SHOCK HAZARD!

The M Series CCT unit can generate up to 2400 volts with sufficient current to cause lethal shocks.

Do not discharge the unit's energy internally more than three times in one minute or damage to the unit may result.

Do not discharge a battery pack except in a Base PowerCharger^{4x4}, a compatible ZOLL Battery Charging/Testing unit, or an M Series unit.

Do not use the M Series unit in the presence of flammable agents (such as gasoline), oxygen-rich atmospheres, or flammable anesthetics. Using the unit near the site of a gasoline spill may cause an explosion.

Do not use the M Series unit near or within puddles of water.

Radio Frequency Interference (RFI)

The M Series unit is protected against interference from radio frequency emissions typical of two-way radios and cellular phones (digital and analog) used in emergency service/public safety activities.

Users of the M Series unit should assess the unit's performance in their typical environment of use for the possibility of radio frequency interference from high-power sources. Radio Frequency Interference (RFI) may be observed as shifts in monitor baseline, trace compression, or transient spikes on the display.

Technical Service

For terms and conditions associated with your warranty, consult your purchasing agreement (for customers in North America) or a ZOLL authorized representative (for customers outside North America).

To maintain this warranty, the instructions and procedures contained in this manual must be strictly followed. For more information, please contact ZOLL Medical Corporation's Technical Service Department at 1-800-348-9011 (North America). If calling from outside North America, contact ZOLL Medical Corporation headquarters at 1-978-421-9655.

Contacting Technical Service

If the M Series unit requires service, contact the ZOLL Technical Service Department:

Telephone: 1-800-348-9011
1-978-421-9655

FAX: 1-978-421-0010

When requesting service for the M Series unit, please provide the following information to the Technical Service representative:

- unit serial number
- description of the problem
- department using the equipment
- sample chart recorder strips documenting the problem, if applicable
- purchase order to allow tracking of loan equipment
- purchase order for a unit with an expired warranty

Returning a unit for service

If you need to send the unit to ZOLL Medical Corporation for repair, you must obtain a service request (SR) number from the Technical Service representative. Units are available on loan while your unit is being repaired.

For customers ...	Return the unit in its original container to ...
in the U.S.A.	ZOLL Medical Corporation 269 Mill Road Chelmsford, MA 01824-4105 Attention: Technical Service Department (SR number)
in Canada	ZOLL Medical Canada Unit #15 5266 General Road Mississauga, Ontario L4W 1Z7 Attention: Technical Service Department (SR number)
outside North America	the nearest authorized ZOLL Medical Corporation Service Center. To locate an authorized service center, contact the International Sales Department at ZOLL Medical at the above-noted address.

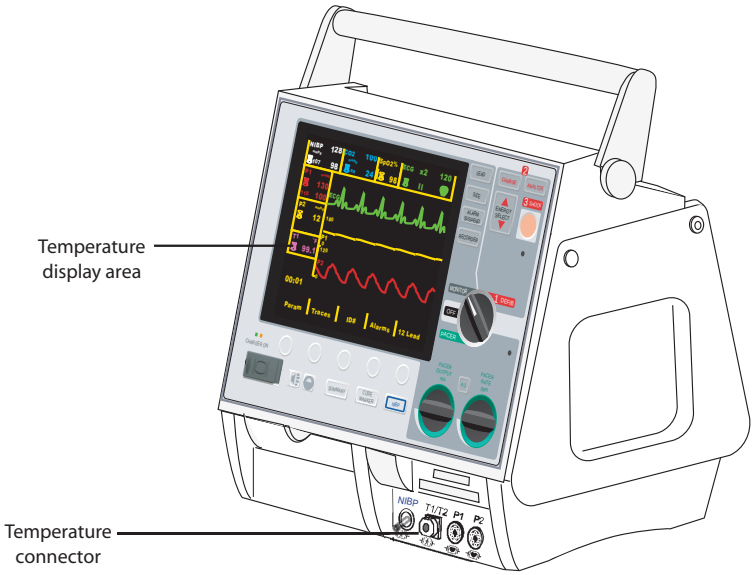
Principles of Operation

The Temperature option on the M Series CCT unit provides temperature monitoring for adult and pediatric patients. The M Series unit can monitor temperature on two different channels and display the two values (T1 and T2) on the monitor, as well as ΔT, the absolute value of the difference between them.

Temperature connector

The IBP/Temperature module resides in the lower housing assembly of the M Series CCT unit. A YSI 400 compatible temperature probe connects to the M Series CCT unit through the temperature connector on the front of the unit. You can use a two-channel Y-adapter to simultaneously connect two temperature probes to the M Series CCT unit.

Figure 1-1: M Series CCT unit with temperature monitoring option



See the *M Series Temperature* insert of the *M Series Operator's Guide* for information on operating the Temperature option.

The M Series CCT unit can display temperature values in either degrees Celsius or degrees Fahrenheit. See the *M Series Configuration Guide* for information on changing temperature units of measurement.

Temperature measurements

The M Series Temperature function measures body temperature by processing electrical signals from a thermistor-type temperature probe contacting the patient. When the M Series CCT unit detects a connection to a temperature probe, the unit initiates temperature measurement automatically.

The temperature measurement cycle proceeds as follows:

Stage	Description
1.	The temperature probe is applied to the patient, and connects to the M Series CCT unit.
2.	The temperature probe converts the patient's temperature to electrical resistance, which is measured by the M Series CCT unit.
3.	The M Series CCT unit uses the electrical resistance to calculate the corresponding temperature in degrees Celsius or Fahrenheit.
4.	The M Series CCT unit displays the numeric temperature values on the monitor. **Note:** If there are two temperature probes connected to the M Series CCT unit, the unit alternates between T1, T2, and ΔT measurement displays.

Maintenance Procedures

It is important that users conduct the Operator's Shift Checklist procedure at the beginning of every shift to maintain the M Series unit ready for immediate use. This checkout procedure can be completed in a few minutes and requires no additional test equipment. See the *M Series Operator's Guide* for the Operator's Shift Checklist.

In addition, a qualified biomedical technician should perform the following maintenance procedure every six (6) months to ensure that the M Series Temperature option is operating properly:

- "Temperature Monitor Test" on page 4

Recording your results

Photocopy the checklist at the back of the *M Series Service Manual* and use the copy to record the results of the maintenance tests.

As you complete each step in a procedure, mark the appropriate Pass/Fail/NA box, and keep the checklist for your maintenance file. Complete all the steps of the procedure before evaluating the test results.

26.0 Temperature Monitor Test

The temperature monitor test verifies the accuracy of measurements on both temperature channels of the M Series CCT unit.

Required equipment

You need the following equipment to complete the temperature monitor test:

- M Series CCT unit with Temperature option (with fully-charged battery installed)
- Fogg TP400 Temperature Probe Simulator (or equivalent)
- 2-channel Y adapter (ZOLL p/n 8000-0675) if using T2 channel

Before you begin

Before you begin the temperature monitor test:

- If testing temperature channel 2, connect the 2-channel Y adapter to the temperature connector (T1/T2) on the M Series CCT unit.
- Connect the Temperature Probe Simulator cable(s) to the temperature connector (T1/T2) on the M Series CCT unit or to the 2-channel Y adapter.

Procedure

Follow these steps to perform the temperature monitor test.

Note: These instructions apply to the Fogg TP400 Temperature Probe Simulator; for equivalent devices, follow the manufacturer's instructions.

Step	Action	Expected Result
26.1	*On the Temperature Simulator*, set the T1 temperature channel to 68º F (20º C).	The Temperature Simulator transmits a temperature of 68º F on the first temperature channel.
26.2	*On the M Series CCT unit*, verify that the value displayed for the T1 temperature channel is accurate within ±0.2º F and in the range of 67.8º to 68.2º F	The M Series CCT unit displays the temperature value for the first temperature channel (T1).
26.3	Optionally, repeat steps 26.1 and 26.2 for the second temperature channel (T2).	The M Series CCT unit displays the temperature value for the second temperature channel (T2).
26.4	*On the Temperature Simulator*, set the T1 temperature channel to 104º F (40º C).	The Temperature Simulator transmits a temperature of 104º F on the first temperature channel.
26.5	*On the M Series CCT unit*, verify that the value displayed for the T1 temperature channel is accurate within ±0.2º F and in the range of 103.8º to 104.2º F	The M Series CCT unit displays the temperature value for the first temperature channel (T1).

Step	Action	Expected Result
26.6	Optionally, repeat steps 26.4 and 26.5 for the second temperature channel (T2).	The M Series CCT unit displays the temperature value for the second temperature channel (T2).
Record your results on the Maintenance Tests Checklist.		

Disassembly Procedures

The IBP/Temperature module resides in the lower housing assembly of the M Series CCT unit. This section describes the following procedure:

• "Removing the temperature cabling and connector" on page 6

For instructions on removing the lower housing assembly from the M Series CCT unit or on replacing the multi-parameter interface cable, see the *Non-Invasive Blood Pressure* insert (part number 9653-0455-01) of the *M Series Service Manual*.

Only properly trained technicians should service the M Series unit. Ensure that you take the appropriate safety precautions before disassembling any part of the M Series unit.

Warning!

SHOCK HAZARD!

Take necessary precautions to guard against shock or injury before conducting defibrillator tests or repairs. The M Series CCT unit can contain lethal voltages even when turned off.

In addition:

- Wear a conductive wrist strap that touches your skin and is connected to a grounding mat and to an earth ground when working with static-sensitive units. Remove the wrist strap when you discharge high voltage or when you are working on energized equipment.

Removing the temperature cabling and connector

The IBP/Temperature module resides in the lower housing assembly of the M Series CCT unit, and connects to the M Series main system board through the multi-parameter interface cable.

Note: For detailed instructions on removing the isolated power supply board and NIBP system board from the CCT lower housing assembly, see the *Non-Invasive Blood Pressure* and *Invasive Blood Pressure* inserts of the *M Series Service Manual*.

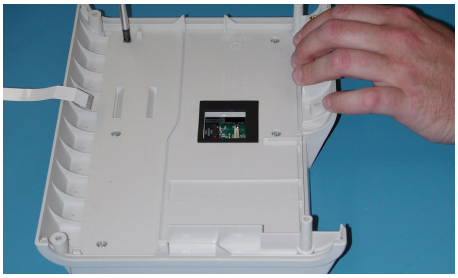
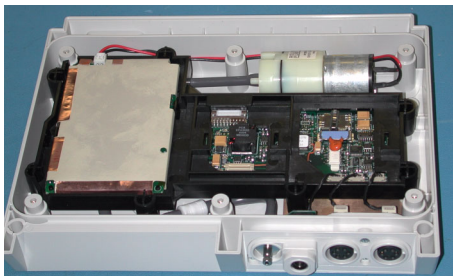
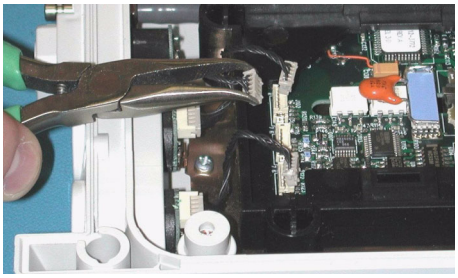
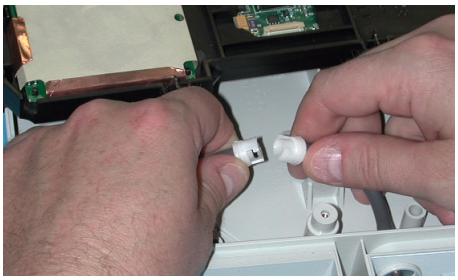
Required tools

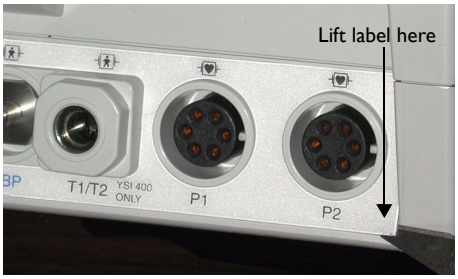
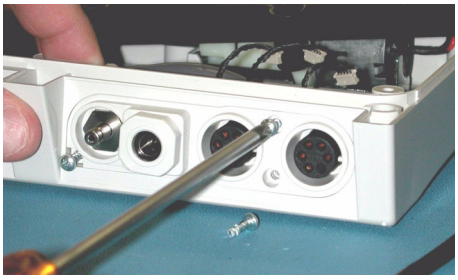
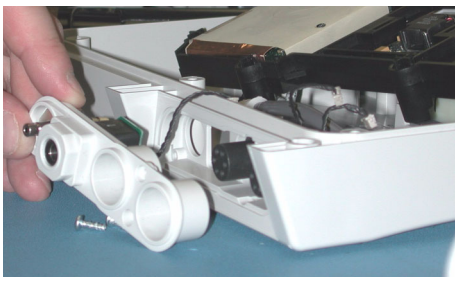
You need the following tools to disassemble the IBP/Temperature module:

- #2 Phillips screwdriver
- small pliers
- small wood stick
- Exacto knife
- anti-static wrist strap

Procedure

Follow these steps to remove the temperature cabling and connector.

Step	Action	
1.	Remove the lower housing assembly from the M Series CCT unit. Refer to the *Non-Invasive Blood Pressure* insert of the *M Series Service Manual* (Disassembly Procedures: “Removing the NIBP module”) for detailed instructions.	
2.	Remove the six (6) screws from the top of the CCT lower housing assembly cover.	
3.	Gently lift the cover away to expose the internal assembly.	
4.	Disconnect the Temperature and IBP cables from the isolated power supply board.	
5.	Lift the frame support and disconnect the tubing assembly (near the NIBP connector).	

Step	Action	
6.	Insert the Exacto knife blade under the connector panel label and gently lift the label away from the CCT connector panel.	
7.	Remove the three (3) screws from the CCT connector panel.	
8.	Gently push the connector panel outwards to detach it from the CCT lower housing assembly.	

Reinstalling the temperature cabling and connector

To reassemble the temperature cabling and connector, reverse Steps 1 through 8 of the above disassembly procedure.

Replacement Parts

You can order replacement parts through an authorized ZOLL distributor or directly from ZOLL Medical Corporation. Pricing information is available from ZOLL Medical Corporation's Technical Service Department.

Note: ZOLL reserves the right to substitute different parts to reflect modifications and improvements in ZOLL M Series circuitry and design.

Ordering replacement parts

When ordering parts, please provide the following information:

- ZOLL M Series device model and serial number
- field-replaceable unit part number
- description of the replacement part

By mail

To order by mail from ZOLL Medical Corporation, address your request to:

ZOLL Medical Corporation
269 Mill Road
Chelmsford, MA 01824-4105

Attention: Technical Service Department

By phone

For more information, contact ZOLL Medical Corporation at 1-978-421-9655 or 1-800-348-9011 (Fax: 1-978-421-0010).

Parts and part numbers

The following table lists the replacement parts available with the Temperature option on the M Series CCT unit.

Table 1-1: Temperature option replacement parts

Description	Part Number
NIBP/IBP/Temperature module	1001-2229
NIBP//IBP/Temperature power supply board	9301-0349
IBP/Temperature connector cable	9500-0311
Temperature connector	9301-0351
NIBP/IBP/Temperature connector panel	9310-1824
Label, NIBP/IBP/Temperature connector panel, English	9305-0727-01

Troubleshooting

The M Series CCT unit displays certain error messages to alert the user to problems detected in the Temperature option operation. The following table lists the Temperature error messages and the associated corrective action.

For further assistance, contact ZOLL Technical Service at 1-800-348-9011. International customers should call the nearest authorized ZOLL Medical Corporation distributor.

Table 1-2: Temperature Error Messages

Message/Symptom	Possible Causes	Corrective Action
CHECK TEMPERATURE PROBE	The temperature probe connection is broken or the unit detects an open circuit.	Check the temperature probe and cabling for loose connections. Replace the temperature probe or cabling as required.